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ABSTRACT

The purpose of this study was to determine the effectiveness of a multisensory spelling intervention under two conditions using high-frequency words written in isolation and in context. The population for the study was 15 fourth and fifth grade students with learning disabilities. A randomized, pretest-posttest control group design was used. The two conditions were designated as non-perceptual vowel enhanced and perceptual-vowel enhanced. The four dependent variables were the subjects' spelling accuracy scores of words written in isolation and in context, each under short-term and long-term delayed recall conditions. Results revealed that the multisensory intervention under the two conditions did not significantly affect the subjects' mean spelling accuracy scores for words written in either isolation or in context among the control and experimental groups. Significant mean spelling accuracy score differences did occur within all groups between both pretest and posttests for words written in both isolation and in context. Research limitations and recommendations for future research are discussed. (Contains 61 references and 16 tables.) (CR)

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Running head: MULTISENSORY SPELLING INTERVENTION

A Pilot Study Investigating a Multisensory Spelling Intervention to Improve Short- and Long-Term Spelling Word Recall for Students with Learning Disabilities

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Abstract

The purpose of this study was to determine the effectiveness of a multisensory spelling intervention under two conditions using high-frequency words written in isolation and in context. The population for the study was fourth and fifth grade students with learning disabilities attending a school in the East Baton Rouge school system. A sample of 15 of these students was randomly selected to participate in this study.

A randomized, pretest-posttest control group design was used. The independent variable was the multisensory spelling intervention under the two conditions with words written both in isolation and in context. The two conditions were designated as non-perceptual-vowel enhanced and perceptual-vowel enhanced. The four dependent variables were the subjects' spelling accuracy scores of words written in isolation and in context, each under short-term and long-term delayed recall conditions. The data were analyzed using SPSS/PC+ 4.0 descriptive and ANOVA statistical modules. Null hypotheses were assumed for all analyses. Two-tailed tests were used with a criterion of significance set at $p<.05$ probability level.

The results revealed that the multisensory intervention under the two conditions did not significantly affect the subjects' mean spelling accuracy scores for Posttest I words written in either isolation or in context among the control and experimental groups. Significant mean spelling accuracy score differences did occur within all groups between both Pretest and Posttest I, and Pretest and Posttest II, for words written in both isolation and in context. The

multisensory intervention under the two conditions also did not significantly affect mean spelling accuracy score differences between Posttest I and Posttest II for words written either in isolation or in context among groups.

The findings of this research are integral to the spelling research literature in their support to teach fourth and fifth grade students with LD within inclusionary classrooms using either traditional or multisensory procedures utilizing 6 to 12 target words. The findings are also important in that they add an intervention utilizing multisensory and format strategies simultaneously to the research literature.

A Pilot Study Investigating a Multisensory Spelling Intervention to Improve Short- and Long-Term Spelling Word Recall for Students with Learning Disabilities

Introduction

A major goal of education is the development of students' abilities to acquire skills consistent with entry into an increasingly complex job market. One overriding skill required by the complexity of the job market is fluent communication in reading and writing. This increasing reliance upon reading and writing for job efficiency is demonstrated by the expanding use of computer technology in the generation of memos, letters, projects, and E-mail; in the use of applications as initial steps in consideration for employment, credit, and security clearances; in the necessity for accurate quotes, contracts, and billing; and in the emerging use of telecommunications. Unquestionably, communication skills in reading and writing are central to optimal achievement in a progressive society.

Reading and writing both involve the use of spelling. Both require the use of accurate spelling to promote clarity of word meaning and ensure smoothness in communication. Spelling accuracy, a characteristic of an educated person (Peters, 1985), is essential to the communication process.

Since the communication process depends, in part, on spelling accuracy, the failure to spell accurately creates discontinuity in meaningful interaction between the writer and the reader. Inaccurate spelling also results in the speller's insecurity and self consciousness as characterized by erasures and slowness in writing

which lower writing productivity (Peters, 1985; Schwertman & Corey, 1989). The complexity of spelling may, therefore, have detrimental effects on both writing productivity and the writer's personality.

Producing accurate written communication is a developmental process in which spelling accuracy increases as students progress through elementary school. Most students progress from a pattern of multiple spelling errors and invented spelling (Cheek, Flippo, & Lindsey, 1997) in the early grades to the approaching of near-accurate spelling by grade four (Henderson, 1990). Some students, however, plateau at lower developmental levels. Indeed, a number of students never attain accuracy in spelling.

One group of students with a characteristic difficulty in spelling accuracy achievement consists of students with learning disabilities (LD) (Gerber & Hall, 1987; Gettinger, Bryant & Fayne, 1982). That spelling difficulty has been attributed to and characterized by these students' weak memory, poor visual sequencing, and poor visual discrimination (Feagans & Merriwether, 1990; Gearheart & Gearheart, 1989; Waldron & Saphire, 1992); cognitive and phonological deficits (Varnhagen & Varnhagen, 1992); and slower recall of base and morphological spellings (Carlisle, 1987). These characteristics impede the developmental process of the attainment of accurate spelling.

A number of instructional strategies have been developed and/or suggested in an attempt to surmount the obstacles in the development of spelling accuracy resulting from the characteristics of students with LD. Many of these strategies emphasize the use of the learner's

various sensory modalities to integrate the memory processes necessary to promote spelling accuracy (e.g., Fernald, 1943; Gillingham & Stillman, 1967; Vaughn, Schumm, & Gordon, 1993). Other suggested strategies address the limitations of memory processes by offering alternative presentation formats in support of students' obtaining more-accurate spelling (e.g., Bryant, Drabin, & Gettinger, 1981; Stevens & Schuster, 1987)(see Tables 1 & 2).

Insert Tables 1 and 2 about here

While research dealing with the effectiveness of these strategies is limited, results of those few studies indicate that while the strategies may promote student development toward spelling accuracy, only limited student success was reported. These results were found when strategies incorporated sensory modalities, diverse structures, or a combination of modality and structural training. Since these few studies reported results revealing only minimal positive effects, further investigations are necessary for clearer confirmation.

According to spelling research, students with LD often require specialized assistance to achieve higher developmental levels in spelling for written communication with adults characterized by accepted spelling accuracy. Specialized assistance can aid students with LD who have characteristics manifested in areas which include: poor visual discrimination, reversals, auditory deficits, weak short and long term memory, underutilization of common words, and short attention span. Lower level developmental spelling errors, for

example, vowel omissions, reversals, addition of an incorrect vowel after a correct vowel, vowel substitution as indicated by Beers, Beers, and Grant (1977), may then be alleviated by using specific strategies. Both skill-based and compensatory interventions are therefore needed to address the needs for improving students with LD's spelling accuracy.

While the literature has addressed one or more of these areas utilizing interventions to either alleviate or compensate for these characteristics with both researched studies and propositions, the literature has not addressed most or all of these simultaneously in a particular manner within one intervention. To address these characteristics simultaneously requires a decision as to the determination of a correct proportionate amount of the intervention areas or components to be included. Thus, those studies and propositions demonstrating the most amount of effectiveness should only be included.

Significantly positive results in achieving increased spelling accuracy have been found within the literature using very specific intervention characteristics. These characteristics take into consideration characteristics of students with LD. The incorporation and subsequent interaction of both intervention characteristics and characteristics typical of students with LD could then enhance spelling accuracy. Therefore, the intent of this study was to examine the spelling accuracy of students with LD by incorporating the following limited number of researched and proposed intervention characteristics for inclusion within the specifically designed intervention:

1. The use of context and perceptual enhancement for high level analysis to promote improved spelling accuracy (Fernald, 1943; Guyer, Banks, & Guyer, 1993; Murphy & McLaughlin, 1990; Ormrod, 1986; Palehonki, 1995; Turner, 1984) .
2. The use of VAKT input to promote improved sensory integration and integrated memory processes (Fernald, 1943; Murphy & McLaughlin, 1990).
3. The introduction of no more than 6 to 12 spelling words a week to prevent memory overload (Bryant, Drabin & Gettinger, 1981).
4. The teaching of high-frequency words to assist in facilitating written communication (Murphy & McLaughlin, 1990).
5. The use of teacher-directed mini-lessons to enhance learning for students with short attention spans (Dowis & Schloss, 1992).

The purpose of this study was to determine the effectiveness of a multisensory spelling intervention under two conditions on students with LD's short- and long-term spelling of high-frequency words in isolation and in context. The experimental intervention incorporated multisensory experiences recommended by Fernald (1943) and Gillingham and Stillman (1967) as well as spelling principles suggested by Hamacheck (1991), Harris, Graham and Freeman (1988), and Graham and Voth (1990), among others. Condition one, non-perceptual-vowel enhancement, provided subjects with no teacher-directed vowel

perceptual experiences (e.g., visual, auditory, kinesthetic, and/or tactile) while condition two, perceptual-vowel enhancement, incorporated general and specific teacher-directed vowel multisensory experiences. The experimental intervention required that target high-frequency spelling words be taught both in isolation and in context and that subjects' spelling accuracy be assessed using short- and long-term recall procedures. It was anticipated that the findings of this study would positively impact the LD and spelling literature. It was also anticipated that the findings of this study would promote further research to determine the effects of experimental spelling interventions on students with and without disabilities' spelling accuracy of high-frequency words.

This pilot study sought to answer the following research questions:

1. Do traditional intervention and multisensory with and without perceptual-vowel enhancement intervention procedures affect students with LD's short-term ability to spell high frequency words in isolation?
2. Do traditional intervention and multisensory with and without perceptual-vowel enhancement intervention procedures affect students with LD's short-term ability to spell high frequency words in context?
3. Do traditional intervention and multisensory with and without perceptual-vowel enhancement intervention procedures affect students with LD's long-term ability to spell high frequency words in isolation?

4. Do traditional intervention and multisensory with and without perceptual-vowel enhancement intervention procedures affect students with LD's long-term ability to spell high frequency words in context?

Four null hypotheses were tested in this pilot study:

1. Students with LD's short-term mean spelling accuracy score of high-frequency words in isolation is not affected by traditional and multisensory with and without-perceptual vowel enhancement intervention procedures.
2. Students with LD's short-term mean spelling accuracy score of high-frequency words in context is not affected by traditional and multisensory with and without perceptual-vowel enhancement intervention procedures.
3. Students with LD's long-term mean spelling accuracy score of high-frequency words in isolation is not affected by traditional and multisensory with and without perceptual-vowel enhancement intervention procedures.
4. Students with LD's long-term mean spelling accuracy score of high-frequency words in context is not affected by traditional and multisensory with and without perceptual-vowel enhancement intervention procedures.

Method

Subjects

Population. The population for this study consisted of fourth and fifth grade students with LD receiving general and special educational services in an elementary school in the East Baton Rouge Parish School

Board System (EBRPSBS). These students met Louisiana's guidelines for LD classification in that they had: (a) significant difficulties in the acquisition, organization, or expression of specific academic skills or concepts; (b) poor performance in such areas as reading, writing, spelling, arithmetic reasoning or calculation, oral expression or comprehension or the acquisition of basic concepts; (c) a significant discrepancy between potential and actual achievement in listening comprehension, oral language, written language, word recognition, reading comprehension, mathematical calculation, or mathematical reasoning; and (d), learning problems that were not primarily the result of visual, auditory, or motor disabilities; mental retardation or emotional disturbance; or environmental, economic, or cultural disadvantage (Office of Special Educational Services, 1994).

Sample. Fifteen of the fourth and fifth grade students with LD in the population above were randomly selected to serve as subjects for this study. Ten (67%)subjects were in grade 4 and five(33%) subjects were in grade 5. Seven(47%) of the subjects were female while eight(53%) were males. The approximated mean age for the total sample was 10.89 years [standard deviation(*SD*) =.73, range = 121 to 152 months (10 - 12 years)]. Table 3 presents the number of subjects at each grade level, gender, and ages for separate groups and as a total group. There were three 10 year old and two 11 year old subjects respectively in both the C and X_1 groups. The X_2 groups consisted of four 10 year old subjects and one 12 year old subject.

Insert Table 3 about here

Table 4 presents subjects' ages in years by grade and gender across groups. Ten(10) of the 15 subjects (67%) were 10 years old, four subjects(27%) were 11 years old, and one subject(7%) was 12 years old. The oldest subject (age 12) was in grade 5. Also, Table 5 presents the mean ages for each group. They were: M_C = 10.82 (*SD* = .58, range = 10.17 to 11.67); M_{X1}= 10.87 (*SD* = .70, range = 10.17 to 11.83); M_{X2} = 10.97 (*SD* = 1.01, range = 10.08 to 12.67). No significant differences were found among groups with respect to mean ages- $F(2,12) = .05$, $p = .95$ (see Table 6).

Insert Tables 4-6 about here

Table 7 presents the sample's Test of Auditory Perceptual Skills(TAPS) Auditory Word Discrimination subtest, Wide Range Achievement Test(WRAT3) Spelling subtest, Pretest High-Frequency Words in Isolation and in Context means, standard deviations, and ranges. The 15 subjects' TAPS total mean score was 9.40 (*SD* = 4.20)and ranged from 1.00 to 14.00 while the WRAT3 total mean score was 83.07(*SD* = 6.19) and ranged from 73.00 to 95.00. The sample's Pretest High-frequency Words in Isolation total mean score was 2.93 (*SD* = 2.58), and ranged from .00 to 9.00 and their Pretest High-frequency Words in Context total mean score was 3.20 (*SD* = 2.98), and ranged from 0.00 to 9.00. Subjects' TAPS, WRAT3, and Pretest High-frequency Words in

Isolation and in Context mean scores by groups are also presented in Table 7.

Insert Table 7 about here

Four Analysis of Variance procedures revealed that subjects by groups had statistically similar TAPS, WRAT3, and Pretest High-frequency Words in Isolation and in Context mean scores (see Table 8).

Insert Table 8 about here

Design and Analyses

A randomized subjects, Pretest - posttest control group design (Ary, Jacobs, & Razavieh, 1990) was utilized to direct this pilot study. The independent variable consisted of a multisensory spelling intervention under two conditions, non-perceptual-vowel enhancement (X_1) and perceptual-vowel enhancement (X_2). The control group received a traditional spelling procedure (C) utilizing general activities (see General Procedures). The four dependent variables that were generated and analyzed were the subjects' in isolation short-term high-frequency words spelling scores (Y_1), in sentence context short-term high-frequency words spelling scores (Y_2), in isolation long-term high-

frequency words spelling scores (Y_3), and in sentence context long-term high-frequency words spelling scores (Y_4).

Subject data were coded, then stored and managed using SPSS/PC+ Data Entry II (SPSS Data Entry II, 1987)(see Appendix C). SPSS/PC+ 4.0 descriptive (means, standard deviations, and ranges) and inferential (one-way analysis of variance [ANOVA]) statistical modules were used to analyze the dependent variables (Norusis, 1990a, 1990b). Two-tailed tests with $p < .05$ criterion for significance were used to determine if the null hypotheses could be rejected.

Instrumentation

Five instruments, two formal(standardized) and three informal (developed by the researcher) were used in this study in the order described. First, the spelling subtest of Wilkinson's (1993) Wide Range Achievement Test 3(WRAT3) was administered to determine the subjects' general spelling achievement levels. The WRAT3 was chosen for its reliability using age norms, the developmental nature of test items, and its ease of administration. The content validity of the WRAT3 has been validated by Wilkinson (1993) using the Rasch statistic for item separation. Wilkinson also reported that the Pearson correlation coefficients between the WRAT3 spelling subtest and the California Test of Basic Skills, California Achievement Test, and Stanford Achievement Test were .84,.72, and .76 respectively. The alternate form reliability correlation coefficient for the WRAT3 spelling subtest for individuals within the norms was calculated to be .98.

Second, the auditory word discrimination subtest of the Test of Auditory-Perceptual Skills (TAPS) (Gardner, 1985) was given to determine the subjects' auditory discrimination general language age levels. This test was chosen for its ease of administration and ability to determine an auditory discrimination language age for grade four and five students. Gardner reported that the content validity was validated for appropriateness and difficulty by teachers, and speech and language pathologists. Reliability coefficients for the auditory word discrimination subtest was calculated using the Kuder-Richardson formula 21 (coefficients ranged from .54-.91) and Cronbach's coefficient *alpha* (AP values ranged from .59-.91).

Third, a two-part pretest (Pretest High-frequency Words in Isolation and in Context), developed by the researcher in collaboration with the subjects' teachers, was administered to determine the subjects' ability to spell high-frequency words both in isolation (Section One) and in context (Section Two). The first section consisted of 25 high-frequency words selected by subjects' teachers from Fry, Fountoukidis, and Polk's (1993) "The Top 240 Instant Words" list (See Appendix A). Teachers used the following two criteria to select the 25 words a) their students have been observed to misspell the 25 words in isolation and in context, and b) their students' misspellings have been related to vowel errors. Each of the 25 words was first listed at random in isolation, followed by the word in a one sentence context, and then repeated in isolation. The administration of Section One consisted of pronouncing each word in isolation, reading the one-sentence context containing the word, and

pronouncing the word in isolation again. The entire list of 25 words in isolation was repeated after the administration of the last high-frequency word. The second section of the Pretest High-frequency Words in Isolation and in Context was developed by the researcher to determine the subjects' ability to spell 15 of the above 25 words within a one-sentence context. The 15 words were selected at random from the high-frequency words in Section One which had been unanimously misspelled by the subjects. Each of the 15 words selected was listed at random in isolation and followed by the word within a one-sentence context which was different from the contextual sentence used in Section one. The administration of Section Two required saying the high-frequency word in isolation and then in a sentence. The sentence was repeated in phrases/sections until all subjects had finished writing the complete sentence. Twelve of the 15 high-frequency words from Section Two unanimously misspelled by the subjects were then selected by the researcher to serve as target words for the control and intervention groups under the experimental conditions (see Appendix A).

Fourth, a two-part short-term posttest(Posttest I) was developed by the researcher and administered the first day following the interventions to assess the subjects' ability to spell the 12 target high-frequency words in isolation and in context. Section One consisted of the 12 target words randomly listed in isolation, followed by the word in a one-sentence context, and again in isolation. Section Two consisted of the 12 target words listed at random in isolation followed by the word within a one-sentence context

(see Appendix A). The procedures used to administer this instrument were similar to those for giving the Pretest High-frequency Words in Isolation and in Context with the exception that Section Two was given directly following the administration of Section One due to time constraints and reliability factors.

Finally, a two-part posttest(Posttest II) was developed by the researcher and administered seven days following the interventions to assess the subjects' ability to spell the 12 target high-frequency words in isolation and in context long-term (see Appendix A). This instrument was developed by using random procedures to change the orders of items in the two-part short-term posttest described above. The procedures used to administer this instrument were similar to those for giving the short-term posttest, Sections One and Two on the same day.

General Procedures

After initial contact with the school site administration and staff willing to participate in this pilot study, 15 fourth and fifth grade students with LD were randomly selected to participate using the Table of Random Numbers. They were randomly assigned to three groups (Traditional, Non-perceptual-vowel enhanced and Perceptual-vowel enhanced). The Traditional (Control) group would receive spelling instruction in which all the spelling words were presented at one time during an initial lesson and further activities followed traditional spelling procedures utilized in general education classrooms. The Non-perceptual-vowel enhanced condition group(X_1) would receive four words daily, integrated visual(V), auditory(A), kinesthetic(K), and

tactile(T) experiences by looking at high-frequency spelling words, orally producing appropriate phoneme repetition, writing words both in isolation and in context, and tracing the words with their fingers. This multisensory intervention is based on both Fernald's (1943) VAKT and Gillingham and Stillman's (1967) VAK approaches. The Perceptual-vowel enhanced condition group (X_2) would receive the same multisensory experiences as X_1 but would also receive teacher-directed multisensory experiences with the vowels in the target words. These vowel experiences would include the visual inspection of vowels, the auditory recognition and vocalization of vowel sounds, the writing of vowels using broad felt markers, and the tracing of vowels with their fingers. The WRAT3 Spelling subtest was given to determine the subjects' spelling achievement age levels and the TAPS Auditory Word Discrimination subtest was given to determine the subjects'ability to discriminate between sounds in one and two syllable words. The researcher in collaboration with students' teachers developed the two-part Pretest High-frequency Words in Isolation and in Context. This instrument was administered over two days the week before the interventions. The control and experimental intervention procedures were implemented. A short-term posttest(Posttest I) was given the day following the intervention to assess the subjects' ability to spell the 12 target high-frequency words in isolation and in context. A long-term posttest(Posttest II) was administered seven days following the intervention to assess the subjects' spelling of the 12 target words in isolation and in context. Subjects data was coded and analyzed.

Results

Four null hypotheses were tested at the .05 alpha level to see if significant differences existed after intervention procedures on short- and long-term spelling accuracy scores among three spelling groups: Control(C), Non-perceptual-vowel enhanced (X_1), and Perceptual-vowel enhanced (X_2). Table 9 presents the subjects' Posttests I and II short- and long term score means, standard deviations, and ranges for words in Isolation and in Context.

Insert Table 9 about here

The data were analyzed using ANOVA procedures. The hypotheses and related findings were:

$H_0$1. The spelling interventions of traditional and multisensory with- and without perceptual-vowel enhancement procedures did not affect students with LD's short-term mean spelling accuracy score of high-frequency words in isolation- $F(2,12) = .40$, $p = .68$ (see Table 10). Therefore, the null hypothesis was accepted.

Insert Table 10 about here

$H_0$2. The spelling interventions of traditional and multisensory with- and without perceptual-vowel enhancement procedures did not affect students with LD's short-term mean spelling accuracy score of high-frequency words in context- $F(2,12) = .24$, $p = .79$ (see Table 11). Therefore, the null hypothesis was accepted.

Insert Table 11 about here

$H_0$3. The spelling interventions of traditional and multisensory with- and without perceptual-vowel enhancement procedures did not affect students with LD's long-term mean spelling accuracy score of high-frequency words in isolation- $F(2,12) = .14$, $p = .87$ (see Table 12). Therefore, the null hypothesis was accepted.

Insert Table 12 about here

$H_0$4. The spelling interventions of traditional and multisensory with- and without perceptual-vowel enhancement procedures did not affect students with LD's long-term mean spelling accuracy score of high-frequency words in context- $F(2,12) = .44$, $p = .65$ (see Table 13). Therefore, the null hypothesis was accepted.

Insert Table 13 about here

Although there were no significant differences in subjects' Posttest I and II Isolation and contextual mean spelling word scores across groups, supplementary paired t-Test analyses revealed that there were differences in subjects' Pre- and Posttest I and II spelling accuracy mean scores within groups. Tables 14 and 15 present paired samples t-Test procedures by groups revealing significant differences for all groups between Pretest High-frequency and

Posttests I and II in Isolation and in Context mean scores. However, there were no significant differences within groups between Posttest I and II in Isolation and in Context mean scores (see table 16). These supplementary findings suggest that both control and experimental interventions were successful for students with LD for both short- and long-term recall.

Insert Tables 14 and 15 about here

Table 16 presents a summary of t-Test procedures for Posttest I and II mean differences by groups. Probabilities ranged from .08 to .30.

Insert Table 16 about here

Discussion

The purpose of this pilot investigation was to determine the effectiveness of a multisensory spelling intervention using high-frequency words written in isolation and in context under two conditions: Non-perceptual-vowel enhanced and perceptual-vowel enhanced, for fourth and fifth grade students with LD. The effectiveness of the intervention under the stated conditions was determined by the subjects' short- and long-term mean spelling accuracy scores in comparison to the mean spelling accuracy scores of subjects taught using a traditional spelling technique. The results, and implications of the results, will be discussed within the context

of these purposes.

The results revealed no significant differences among the experimental and control groups on short- and long-term memory mean spelling accuracy scores of words either in isolation or in context. It was anticipated that subjects in the perceptual-vowel enhanced group (X_2) would have significantly higher mean spelling accuracy scores than subjects in either the Non-perceptual-vowel enhanced group (X_1) or the control group (C). It was also anticipated that subjects in group X_1 would have statistically higher spelling accuracy scores than subjects in group C. Vickery and Reynolds (1987), for example, successfully implemented multisensory techniques using a modified Orton-Gillingham-Stillman approach (Multisensory Teaching Approach for Reading, Spelling, and Handwriting- MTARSH) and reported it to be effective for elementary school students classified as either remedial or nonremedial students. Although no statistically significant differences were found for mean spelling accuracy isolation and in context mean scores among groups in this pilot study, differential statistically significant improvement in mean spelling accuracy scores between Pretest High-frequency Words in Isolation and in Context and Posttests I and II was revealed within groups. These findings and the following "implications for practice" (Kay, Fitzgerald, Paradee, & Mellencamp, 1994, p. 558) may be drawn from this study:

Spelling Intervention and Short- and Long-Term Recall Findings, Discussion and Implications

There were no significant differences among groups on short-term spelling accuracy mean scores for high-frequency words spelled in

isolation. This is in agreement with Vaughn, Schumm, and Gordon (1993) who found no mean score differences between writing, tracing, or computer conditions although these researchers presented each group with an intervention with specific attention to vowels and consonants, modeling, copying, and self-checking components. It is hypothesized that the element of constant rechecking of letters may have overloaded the working memory for the 15 subjects with LD who participated in this pilot study. This implies a need for increased attention to and similarity of activity for a particular task without any change or interruption.

The short-term recall results of this investigation are also in agreement with Kearney and Drabman's (1993) findings in that statistically significant differences towards improvement were found within groups between Pretest High-frequency Words in Isolation and in Context and Posttest I spelling accuracy scores. It is hypothesized that the Kearney and Drabman component within this pilot study intervention was of significance due to the elements of consecutive writing of spelling words prior to exposure of new target words. The short-term recall findings are also in agreement with Bryant, Drabin, and Gettinger's (1981) and Graham and Voth's (1990) reported results in that the number of words taught should be limited to 6 to 12. It is therefore hypothesized that, although a subject may miss between 6 and 12 words, the writing out of these words at the beginning of the intervention is still within the confines of the working memory capacity of individuals with LD in addition to the reinforcing practice of writing and seeing the words. The writing out of these few

words at the beginning of an intervention also implies a viable manner for immediately and successfully increasing specific on-task behavior.

Additionally, the results of this pilot study suggest that there were no significant differences among groups for short-term recall in spelling accuracy for words written in context. This finding is in disagreement with Palehonki(1995) who found a difference between a traditional spelling procedure and a whole-part-whole spelling in context procedure with general education first grade students. A number of reasons could account for this variance in findings. First, it is hypothesized that both different grade levels (grade 1 vs. grades 4 & 5) and types of subjects (general education vs. individuals with LD) influenced the non-significant results in this pilot study. Many of the subjects in this pilot study were having to cope with continuous spelling accuracy failure at a fourth or fifth grade level. This contrasts with the first grade students who were at developmentally earlier stages of spelling but incurring success and would probably have noted slow improvement themselves. Second, it is also hypothesized that Palehonki's use of a rhyme and rhythm procedure within the first grade spelling intervention may have accounted for this researcher's significant results; rhyme and rhythm were not used in this pilot study. The use of spelling patterns has been suggested for use in directed-spelling activities by Graham, Harris, and Loynachan (1996) to improve spelling accuracy. Therefore, the multisensory procedures applied in this pilot study should incorporate patterning of spelling words within contexts for improved spelling word accuracy if used in future studies.

The long-term recall results of this investigation revealed no differences across groups for subjects' long-term memory spelling accuracy scores of words in isolation. This contrasts with the findings of Murphy and McLaughlin (1990) who reported a modest increase of target word retention in long-term retention. It is hypothesized that the three differing elements between Murphy and McLaughlin and this pilot study may have accounted for this variance: First, Murphy and McLaughlin used a simpler specifically designed tracing element in addition to their auditory and visual components in contrast to this pilot's study of using a multisensory procedure. Second, Murphy and McLaughlin used only one subject in comparison to this study's 15 subjects (five in one group). Third, the intervention time used in Murphy and McLaughlin's study was set before school in contrast to this pilot study in which all groups were already within the school and moving through regular class time schedules. It is also hypothesized that a simpler method for the multisensory approach, especially with the perceptual-vowel enhanced group, will increase the differences between the experimental and control Posttests means. Also, it is hypothesized that the decreased attention to each student within this study's groups may have influenced the findings of this pilot study. It is hypothesized that a different intervention time (as noted below in the recommendations) may significantly improve future subjects' and students with LD's long-term retention for spelling words.

This investigation also revealed that there were no significant differences between groups for long-term recall in spelling word

accuracy of words in context. This also contrasts with Murphy and McLaughlin's (1990) results in that their subject retained more words written in context than in isolation. Similarly, method, subject design and time may have significantly influenced the differing findings. Murphy and Mclaughlin used a simpler multisensory auditory and visual component with tracing method. They also used one subject in contrast to 15 in this study (five in a group). Finally, and as noted above, Murphy and McLaughlin scheduled their intervention prior to the commencement of school activities in contrast to this pilot study in which the intervention was set after the commencement of school activities.

The long-term recall findings of this pilot study are in disagreement with Stevens and Schuster (1987) who utilized a time-delay spelling intervention with one subject. This subject generalized the 15 target words within the contexts of five individually dictated sentences after three weeks. Stevens and Schuster's study contrasts with this pilot study with respect to two variables: method and subject design. First, Stevens and Schuster used no multisensory procedures but a simple modeling technique with no contextual practice and generalization probes to other settings. Second, only one subject was used in this study in contrast to the 15 subjects (five subjects in one group) utilized in this pilot study. It is hypothesized that tediousness during the multisensory procedure in this pilot study may have contributed to a lack of attention to vowel detail. Therefore, it could be concluded that special attention should be given to each word after it is written to increase the amount of visual input and thereby

improve the equalization of visual attentiveness to kinesthetic attentiveness. It is also hypothesized that more writing activities within various contexts should have occurred during the experimental intervention to better accustom the subjects to actually writing words in various contexts. The variety of subject writing speed within group X_2 may also have significantly affected the greater differences between Posttest I and II mean spelling accuracy of words in context. One subject in X_2 was extremely slow in writing out words. Subjects in group X_1, as the most homogenous group with respect to writing speed, can be noted to have the smallest difference between Posttest I and II mean spelling accuracy of words in context

In addition to the above implications, four additional implications can also be generated from the findings of this pilot study. These implications include:

1. The findings of this study revealed a need to differentiate between the effects of the multisensory procedure, components of Kearney and Drabman's (1993) spelling intervention, and the combination of the two procedures. Each of the interventions may also eventually delineate differences in teaching words in isolation and in context between various subtypes of individuals with LD.
2. The results suggest that further research is required to more efficiently determine informational processes utilized to enhance spelling accuracy in relation to long-term memory using a modified replicative procedure.

3. The above findings support the research literature which indicates that teachers may include both traditional and multisensory strategies incorporating the spelling principles utilized in this study within their spelling instruction for both fourth and fifth grade students with LD within inclusionary settings. It must be noted, however, that one important limitation does exist. Within the instructional spelling procedures is the restriction for using only 12 target spelling words. Finally, no more than four words should be introduced on a daily basis.

4. Teachers adopting multisensory procedures using either perceptual- or non-perceptual-vowel enhancement will be able to expect spelling accuracy improvement as shown by the *post hoc* analyses in this investigation. The limitations of time must be taken into consideration when multisensory procedures are to be incorporated.

These implications for practice may then enhance the achievement and self-esteem of students with LD having characteristic spelling problems. They also may promote additional investigations into long-term spelling word accuracy for students with LD.

Limitations

Five limitations related to this pilot study must be noted. They are as follows:

1. The sample of elementary students with LD used in this study was randomly selected from only one elementary school in the East Baton Rouge Parish School Board System.

Generalization of the results are thus limited to the particular elementary school in which the subjects were enrolled.

2. The spelling intervention activity of consistently repeating similar procedures for X_1 and X_2 may not have held subjects' complete interest. A low interest in words may have limited their attention span.

3. The length of the spelling intervention was a limitation and may have affected the results of this study. The time required to complete the intervention task impeded the achievement of closure on the first day for X_1. Therefore, to maintain consistency, closure was not initiated for X_2 on the same day. No closure activity was initiated on subsequent days for any group primarily due to the extended time requirement for the interventions and individual differences in writing and thinking speed within the groups.

4. The subjects appeared to be affected negatively in their attention to the tasks required during the spelling interventions due to the necessitated change of environment during this period of December festivities and the forthcoming vacation.

5. Absenteeism may also have had an effect on the mean spelling accuracy scores of Group X_2. One subject in X_2 was absent on Wednesday and Thursday of the intervention. This limited the individual's amount of exposure to the target spelling words which, in turn, may have significantly reduced the subject's

score and influenced the mean score of the group. This same subject was absent on Friday. Therefore, the subject took the Posttest I on the following Monday. Both the lack of exposure to and extended time period prior to taking Posttest I may therefore also have affected the spelling accuracy scores. Finally, one subject in Group X_2 was absent for the Friday Posttest II and took the long-term recall test on the following Monday which may also have affected the group's mean score.

Recommendations

Based on the limitations of this study, five recommendations are made for future research:

1. The subject sample was taken from one school in East Baton Rouge Parish School Board System. This limits the generalizability of the results to that particular school population. It is recommended that samples be taken from a wider variety of schools to assist in generalizing the results to the general population.
2. The quick speed with which words were often written and traced by some subjects during the non-perceptual- and perceptual-vowel enhanced spelling interventions may have significantly affected the conscious memorization of each target word. Writing speed could be better controlled by researchers in a smaller and younger group of students with LD. Slower writing speeds may promote increased perceptual awareness and attention.

3. It was also found that the repetitive writing of target words up to 15 times as suggested by Kearney and Drabman(1993) for certain subjects with LD was too time consuming. In addition, this inefficient use of time for the other subjects who did need to write out words, may have caused these subjects to lose interest. Interest loss may require an enhanced anticipatory set component within the intervention. Based on observations during this investigation it is therefore suggested that misspelled pre-assessment words within the intervention be written out no more than 7 times.

4. The time placement of this investigation significantly influenced two factors in this study. a) This study was conducted during the final weeks of the first school term. During this time period three factors most likely decreased subject's attention during the spelling intervention: class-wide testing may have increased tiredness with subsequent lack of concentration, December festivities causing variations in routines, and the anticipated end of the school term. Therefore, it is further recommended that this type of research be completed during the middle of the school term being free from: concentrated testing activities, less structured and unanticipated activities, and anticipation for upcoming vacations. b) The allotment of 20 to 25 minutes for the non-perceptual- and perceptual-vowel enhanced spelling interventions was insufficient. A 40

minute maximum is justifiable for the combination of the Kearney and Drabman (1993) component of the spelling intervention and the multisensory procedures for 12 target words. Due to this lack of intervention time, the closing activity of the spelling intervention could not be completed for X_1 on the first day. Subsequently, no closing activity was initiated for any group during the rest of the week for consistency purposes. It is suggested that the closing activity be modified to simple techniques such as spelling words out loud. Also, the utilization of a 10 target word limit will be more appropriate within the time frame of the intervention. This will also alleviate any tediousness of continued writing, create some variation, assist recall, and decrease further time consumption. c) The three groups each had a scheduled time for their intervention (Control group, Non-perceptual-vowel enhanced, Perceptual-vowel enhanced). This schedule was adhered to throughout the week. It is recommended that, if realistically possible, each group completes its intervention at the same time (e.g., C from 9:00 - 9:30, X_1 from 9:00 - 9:30, X_2 from 9:00 - 9:30) to equalize groups for fatigue, etc. and improve reliability.

Five additional recommendations beyond the limitations should also be noted:

1. It is suggested that an ample amount of time be scheduled to allow for possible impediments toward the completion of the intervention and thus interfering with scheduled recess/

lunch times. A number of subjects anxiously watched the very visible clock hanging above the chalkboard. Anxiety may cause decreased attention and memory loss. Consequently, it is also suggested that classroom clocks be removed prior to the commencement of research studies.

2. Additional practice of writing words in context within the daily intervention may create more automatic retrieval for target word accuracy in context on Posttests. Shortened automatic target word retrieval may improve the writing of target words in context due to the increased memory processing load for the contextual words. It is therefore suggested that the three days of word introduction in the intervention be lengthened to four days (with less words introduced daily)with an increased emphasis on writing words in context.

3. Contrasting vowels and consonants did not produce any differences in this study. Since the active changing of pencil to marker and from one paper to another was almost completely memorized by the second day of the intervention by some students, more focused attention could then be given to contrasting vowels and consonants in X_2. As noted by Graham, Harris, and Loynachan (1996), contrast continues to be considered of great importance for students with LD in teaching high-frequency words. Contrasting letters and/or parts of whole words using contrasting spelling patterns may require additional attention and thought processes. This

could assist individuals with LD and developmentally delayed learners since they often have difficulty learning rules for syllabification and should not be required to apply them quickly in either reading or spelling processes. These individuals often benefit from linguistic word patterns and use of phonemic segmentation (O'Conner & Jenkins, 1995; van Bon & Duighuisen, 1995). Gerber and Hall (1987) also concluded that individuals with LD have different phonemic boundaries in words, have different organizational patterns, and attempt to be as economical as possible in writing phonemes. It is therefore recommended that a multisensory approach incorporating these aspects (which includes attention to small words within the larger word) could then be contrasted with digraphs (e.g., ph, ea, etc.) and placed within linguistic patterns (e.g., Am-eri-can, Af-ri-can, or f-eat, s-eat).

4. In contrast to Thorpe, et al. (1981) whose subjects drew lines underneath words for added attention to the word, it is also recommended that left-right horizontal lines be drawn through the center of each word while saying the word. In this way, each letter could be more consciously observed. The combination of linguistic patterns, phonemic segmentation, and drawing lines are indeed areas for future research.

5. Future spelling research with students with LD should continue in order to increase the knowledge base of spelling

research. The broader spelling intervention knowledge base can then be utilized by teachers for use in inclusive, resource, and self-contained classrooms. These interventions could also include specific components such as additional attention cues and recall elements. These components have been reported to be successful with students having ADD/ADHD (Zentall, 1989). Consequently, the interventions may assist students with ADD/ADHD, dual diagnosis ADD/ADHD and LD, individual subtypes of LD, in addition to generic students with LD.

In summary, research incorporating interventions utilizing varied and larger populations, increased time for both the intervention and components within the intervention, and contrasting patterns in accordance with phonemic segmentation using non-standard but systematic patterns, could improve spelling deficiencies in student with LD. These interventions may also be applicable to individuals with ADD/ADHD, emotional-behavioral disorders, and individual subtypes of LD.

Summary

This pilot study utilized intervention characteristics to enhance spelling accuracy for students with learning disabilities. These characteristics consisted of the use of context and perceptual- vowel enhancement, VAKT input for sensory integration, the introduction of no more than 6 to 12 spelling words in one week and teacher directed mini-lessons.

This pilot investigation was important by corroborating other

research in that students with LD optimum spelling accuracy achievement of high-frequency words is from 6 to 12 words per week (Graham & Fayne, 1982; Graham & Voth, 1990; Kearney & Drabman 1993; Vaughn, Schumm, & Gordon, 1993). Since former research has addressed various strategies utilizing format (Bryant, Drabin, & Gettinger, 1981; Darch & Simpson, 1990; Stevens & Schuster, 1987) or multisensory instruction (Fernald, 1943; Isaacson, Rowland, & Kelly, 1987; Kearney & Drabman, 1993; McDermott & Watkins, 1983; Thomas & Nagel, 1988; Turner, 1984), this study is uniquely important in its procedure to simultaneously address context, VAKT, perceptual-vowel enhancement, high-frequency words, and "extended" minilessons resulting in some improvement in spelling accuracy. Third, this study is significant by suggesting that further research is required to more efficiently determine informational processes utilized to enhance spelling accuracy combined with long-term memory using a modified replicative procedure

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Appendix A

Instrumentation

Instrumentation

The Top 240 Instant Words

the	of	and	a	to	in
is	you	that	it	he	was
for	on	are	as	with	his
they	I	at	be	this	have
from	or	one	had	by	words
but	not	what	all	were	we
when	your	can	said	there	use
an	each	which	she	do	how
their	if	will	up	other	about
out	many	then	them	these	so
some	her	would	make	like	him
into	time	has	look	two	more
write	go	see	number	no	way
could	people	my	than	first	water
been	called	who	oil	its	now
find	long	down	day	did	get
come	made	may	part	over	new
sound	take	only	little	work	know
place	years	live	me	back	give
most	very	after	things	our	just
name	good	sentence	man	think	say
great	where	help	through	much	before
line	right	too	means	old	any

Instrumentation (Cont'd.)

The Top 240 Instant Words (Cont'd.)

same	tell	boy	following	came	want
show	also	around	form	three	small
set	put	end	does	another	well
large	must	big	even	such	because
turned	here	why	asked	went	men
read	need	land	different	home	us
move	try	kind	hand	picture	again
change	off	play	spell	air	away
animals	house	point	page	letters	mother
answer	found	study	still	learn	should
American	world	high	every	near	add
food	between	own	below	country	plants
last	school	father	keep	trees	never
started	city	earth	eyes	light	thought
head	under	story	saw	left	don't
few	while	along	might	close	something
seemed	next	hard	open	example	beginning

From Fry, E. B., Kress, J. E. Fountoukidis, D. L., & Polk, J. K. (1993). The reading teacher's book of lists (3rd ed.) Des Moines, IA:

SPELLING PRETEST HIGH-FREQUENCY

WORDS IN ISOLATION

1. many
2. write
3. where
4. sentence
5. through
6. which
7. their
8. country
9. light
10. example
11. American
12. because
13. thought
14. might
15. something
16. picture
17. again
18. does
19. following
20. started
21. while
22. beginning
23. different
24. turned
25. between

SPELLING PRETEST HIGH-FREQUENCY

WORDS IN CONTEXT

1.	through	The saw blade went <u>through</u> the tree trunk.
2.	beginning	It is the <u>beginning</u> of winter.
3.	example	A good <u>example</u> helps us to learn.
4.	American	The <u>American</u> flag was on the pole.
5.	which	She showed him <u>which</u> way to go.
6.	following	Please do the <u>following</u> problems.
7.	different	The food was <u>different</u> than at home.
8.	turned	The car <u>turned</u> around.
9.	thought	The man <u>thought</u> he saw a deer.
10.	does	How <u>does</u> a clock tick?
11.	between	Draw a line <u>between</u> the words.
12.	sentence	The <u>sentence</u> is on the paper.
13.	their	It was <u>their</u> brown dog.
14.	where	He wanted to go <u>where</u> the sun shone all day.
15.	country	The country was very pretty.

SPELLING POSTTEST I

Words in Isolation

	WORD	TEACHER-DICTATED SENTENCE
1.	their	She had their present.
2.	turned	The car turned into the driveway.
3.	does	The lady does much typing.
4.	which	He knew which one to pick.
5.	example	John's example was perfect.
6.	following	Please do the following thing.
7.	beginning	The beginning of the story was good.
8.	sentence	A sentence is a group of words.
9.	different	We need a different table.
10.	American	Richard was an American.
11.	through	The water leaked through the roof.
12.	where	This is where we start.

SPELLING POSTTEST I

Words in Context

	WORD	TEACHER-DICTATED SENTENCES WRITTEN BY THE STUDENT
1.	example	This is an example.
2.	following	He is following the car.
3.	which	I see which one it is.
4.	through	The lady went through the gate.
5.	does	He does some hunting.
6.	turned	I turned around.
7.	American	It was an American book.
8.	sentence	She wrote one sentence.
9.	where	The man sees where the fire is.
10.	their	Look at their houses.
11.	different	The bag looked different.
12.	beginning	The beginning song was fun.

SPELLING POSTTEST II

Words in Isolation

	WORD	TEACHER-DICTATED SENTENCE
1.	different	The house was painted a different color.
2.	where	This is where the tree should be planted.
3.	turned	Tilly turned the paper over.
4.	their	The number belonged to their house.
5.	which	I don't know which one it is.
6.	does	Jacques also does some paint spraying.
7.	through	Marian and David crawled thought the fort.
8.	American	The American figure skater did excellent twirls.
9.	following	The following airplanes will leave soon.
10.	beginning	The beginning was more difficult than the end.
11.	example	The math example was on the board.
12.	sentence	The sentence had a conjunction in it.

SPELLING POSTTEST II

Words in Context

	WORD	TEACHER-DICTATED SENTENCES WRITTEN BY THE STUDENT
1.	where	The box is where I put.
2.	turned	The rain turned into snow.
3.	American	It was an American football game.
4.	which	I know which apples to pick.
5.	their	The rake belongs to their Grandmother.
6.	beginning	The orange is beginning to rot.
7.	sentence	The short sentence was made longer.
8.	through	He put the wire through the pipe.
9.	different	The princess looked different in the pink dress.
10.	following	Dogs like following some people.
11.	does	The machine does not wash well.
12.	example	The best example was picked.

Table 1

Strategies Which Emphasize Various Sensory Modalities

Multisensory instruction	-(Blau & Loveless, 1982; Fernald, 1943; Gillingham & Stillman, 1967; Harris, Graham & Freeman, 1988; Kearney & Drabman, 1993; Murphy & McLaughlin, 1990; Vaughn, Schumm, & Gordon, 1993);
Visual imagery	-(Malloy, 1987; Radebaugh, 1985; Sears & Johnson, 1986; Thomas & Nagel, 1988);
Color cuing/analysis	-(Guyer, Banks, & Guyer, 1993; Turner, 1984; Palehonki, 1995; Zentall, 1989);
Fingerspelling	-(Bonvillian, 1983; Isaacson, Rowland, & Kelley, 1987; Stein, 1983;
Computer-assisted instruction	-(McDermott & Watkins, 1983);
Oral spelling	-(Henderson, 1990; Ormrod & Jenkens, 1988).

Table 2

Strategies Which Emphasize Format

Rule-based instruction	-(Darch & Simpson, 1990);
Time-delay	-(Stevens & Schuster, 1987);
Number of words	-(Bryant, Drabin & Gettinger, 1981; Graham & Voth, 1990; Miller, 1956; Sipe, 1994; Vaughn et al.,1993);
Teacher-directed mini-lessons	-(Dowis & Schloss, 1992);
Word analysis	-(Guyer, Banks, & Guyer 1993; Wong, 1986; Zentall, 1989).

Table 3

Subjects' General Demographics of Grade, Gender, and Age by Group[a]

Variable	Group C	X_1	X_2	Total
	N(%)	N(%)	N(%)	N(%)
Grade				
4	3(60)	4(80)	3(60)	10(67)
5	2(40)	1(20)	2(40)	5(33)
Gender				
Female	2(40)	1(20)	4(80)	7(47)
Male	3(60)	4(80)	1(20)	8(53)
Age(in years)				
10	3(60)	3(60)	4(80)	10(67)
11	2(40)	2(40)	0(0)	4(27)
12	0(0)	0(0)	1(20)	1(07)

[a] Total N = 15

Table 4

Subject's Age by Group, Grade, and Gender

Group	C				X_1				X_2			
Grade	4		5		4		5		4		5	
Gender	F	M	F	M	F	M	F	M	F	M	F	M
Age												
10	2	1	0	0	1	2	0	0	2	0	1	1
11	0	0	0	2	0	1	0	1	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	1	0

Table 5

Subjects' Age Means, Standard Deviations, and Ranges by Groups'

Groups	Means	SD	Range
C	10.82	.58	10.17 - 11.67
X_1	10.87	.70	10.17 - 11.83
X_2	10.97	1.01	10.08 - 12.67
Total	10.89	.73	10.08 - 12.67

' Subjects' ages were converted from months to years by dividing their total number of months by 12.

Table 6

Oneway ANOVA Summary Table for Subjects' Ages(in months) by Groups

Source	*SS*	*df*	*MS*	*F*	*p*
Between	8.40	2	4.20	.05	.95
Within	1069.20	12	89.10		
Total	1077.60	14			

Table 7

Summary Table of Subjects' TAPS Auditory Word Discrimination subtest, WRAT3 Spelling Subtest, and Pretest High-frequency Words in Isolation and in Context Means, Standard Deviations, and Ranges by Groups[c]

Group	Test/Subtest	Mean	SD	Range
	TAPS[a]			
C		9.60	4.39	2.00 - 13.00
X_1		8.80	5.89	1.00 - 14.00
X_2		9.80	2.68	7.00 - 14.00
Total		9.40	4.20	1.00 - 14.00
	WRAT3[b]			
C		85.40	5.77	81.00 - 95.00
X_1		79.20	7.46	73.00 - 92.00
X_2		84.60	4.09	78.00 - 95.00
Total		83.07	6.19	73.00 - 95.00
	Pretest High-frequency/Isolation			
C		3.40	1.34	2.00 - 5.00
X_1		2.00	2.34	0.00 - 6.00
X_2		3.40	3.40	0.00 - 9.00
Total		2.93	2.58	0.00 - 9.00
	Pretest High-frequency/Context			
C		3.20	1.30	2.00 - 5.00
X_1		2.60	3.65	0.00 - 9.00
X_2		3.80	3.90	0.00 - 9.00
Total		3.20	2.98	0.00 - 9.00

[a] TAPS Scaled scores
[b] WRAT3 Standard scores (spelling subtest)
[c] N=15

Table 8

Oneway ANOVA Summary Table for Subjects' TAPS Auditory Word Discrimination Subtest, WRAT3 Spelling Subtest, Pretest High-frequency Words in Isolation and in Context Mean Scores by Groups.

Test/Subtest	*Source*	*SS*	*df*	*MS*	*F*	*p*
TAPS						
	Between	2.80	2	1.40	.07	.93
	Within	244.80	12	20.40		
	Total	247.60	14			
WRAT3						
	Between	113.73	2	56.87	1.61	.24
	Within	423.20	12	35.27		
	Total	536.93	14			
Pretest High-frequency/Isolation						
	Between	6.53	2	3.27	.45	.65
	Within	86.40	12	7.20		
	Total	92.93	14			
Pretest High-frequency/Context						
	Between	3.60	2	1.80	.18	.84
	Within	120.80	12	10.07		
	Total	124.40	14			

Table 9

Group	Test/Subtest	Mean	SD	Range
	PosttestI/Isolation			
C		9.80	2.17	7.00-12.00
X_1		8.00	3.74	2.00-12.00
X_2		8.00	4.63	3.00-12.00
Total		8.60	3.50	2.00-12.00
	Posttest I/Context			
C		9.20	3.11	4.00-12.00
X_1		7.60	3.98	1.00-11.00
X_2		7.60	5.23	1.00-12.00
Total		8.13	3.96	1.00-12.00
	Posttest II/Isolation			
C		7.80	2.78	5.00-11.00
X_1		7.00	3.39	3.00-11.00
X_2		6.60	4.50	1.00-12.00
Total		7.13	3.40	1.00-12,00
	Posttest II/Context			
C		8.20	2.39	5.00-11.00
X_1		7.20	3.90	1.00-11.00
X_2		6.00	4.53	1.00-11.00
Total		7.13	3.56	1.00-11.00

[a] **Total N = 15**

Table 10

Oneway ANOVA Summary Table for Subjects' Posttest I in Isolation Spelling Word Scores by Groups

Source	*SS*	*df*	*MS*	*F*	*p*
Between	10.80	2	5.40	.40	.68
Within	160.80	12	13.40		
Total	171.60	14			

Table 11

Oneway ANOVA Summary Table for Subjects' Posttest I in Context Spelling Word Scores by Groups

Source	*SS*	*df*	*MS*	*F*	*p*
Between	8.53	2	4.27	.24	.79
Within	211.20	12	17.60		
Total	219.73	14			

Table 12

Oneway ANOVA Summary Table for Subjects' Posttest II in Isolation Spelling Word Scores by Groups

Source	*SS*	*df*	*MS*	*F*	*p*
Between	3.73	2	1.87	.14	.87
Within	158.00	12	13.17		
Total	161.73	14			

Table 13

Oneway ANOVA Summary Table for Subjects' Posttest II in Context Spelling Word Scores by Groups

Source	*SS*	*df*	*MS*	*F*	*p*
Between	12.13	2	6.07	.44	.65
Within	165.60	12	13.80		
Total	177.73	14			

Table 14

Summary Table for Paired Samples t-Test Subjects' Pretest High-frequency and Posttest I in Isolation and Context Spelling Word Scores by Group

Group	*Test(Iso)*	*Mean*	*t*	*df*	*p*
C	Pretest	3.40			
	Posttest I	9.80	-10.67	4	.01
X_1	Pretest	2.00			
	Posttest I	8.00	- 5.26	4	.01
X_2	Pretest	3.40			
	Posttest I	8.00	- 4.69	4	.01
Group	*Test(Con)*	*Mean*	*t*	*df*	*p*
C	Pretest	3.20			
	Posttest I	9.20	-6.00	4	.01
X_1	Pretest	2.60			
	Posttest I	7.60	-3.30	4	.03
X_2	Pretest	3.80			
	Posttest I	7.60	-3.92	4	.02

Table 15

Summary Table for Paired Samples t-Test Subjects' Pretest High-frequency and Posttest II in Isolation and Context Spelling Word Scores by Group

Group	*Test(Iso)*	*Mean*	t	*df*	*p*
C	Pretest	3.40			
	Posttest II	7.80	-5.05	4	.01
X_1	Pretest	2.00			
	Posttest II	7.00	-5.27	4	.01
X_2	Pretest	3.40			
	Posttest II	8.60	-4.82	4	.01
Group	*Test(Con)*	*Mean*	t	*df*	*p*
C	Pretest	3.20			
	Posttest II	8.20	-7.07	4	.01
X_1	Pretest	2.60			
	Posttest II	7.20	-3.37	4	.03
X_2	Pretest	3.80			
	Posttest II	6.00	-4.49	4	.01

Table 16

Summary Table for Paired Samples t-Test Subjects' Posttest I and Posttest II in Isolation and Context Spelling Word Scores by Group

Group	*Test(Iso)*	*Mean*	*t*	*df*	*p*
C	PosttestI	9.80			
	Posttest II	7.80	1.83	4	.14
X_1	Posttest I	8.00			
	Posttest II	7.00	1.20	4	.30
X_2	Posttest I	8.00			
	Posttest II	6.60.	2.33	4	.08

Group	*Test(Con)*	*Mean*	*t*	*df*	*p*
C	Posttest I	9.20			
	Posttest II	8.20	1.41	4	.23
X_1	Posttest I	7.60			
	Posttest II	7.20	1.63	4	.18
X_2	Posttest I	7.60			
	Posttest II	6.00	2.36	4	.08